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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/576,230

04/14/2006

Atsushi Yabe

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EXAMINER

BAREFORD, KATHERINE A

ART UNIT

PAPER NUMBER

1792

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/576,230	<b>Applicant(s)</b> YABE ET AL.	
	<b>Examiner</b> Katherine A. Bareford	<b>Art Unit</b> 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 14 April 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,4 and 5 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,4 and 5 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>4/14/06</u>   | 6) <input type="checkbox"/> Other: _____                          |

### DETAILED ACTION

1. The preliminary amendments of April 14, 2006 have been received and entered. With the entry of the amendments, claims 2 and 3 have been canceled, and claims 1, 4 and 5 are pending for examination.

### *Specification*

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

### *Claim Rejections - 35 USC § 112*

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:  
  
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
4. Claim 4 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 4, a pretreatment agent is formed, and the mirror surface is treated with the pretreatment agent, but it is not clarified when in the process the pretreatment agent treats the surface. Is it before or after the electroless plating?

### *Claim Rejections - 35 USC § 103*

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo et al (US 4834796) in view of Uzoh et al (US 2003/0160326) and Maenosono (US 2001/0021466).

Kondo teaches an electroless copper plating method. Column 1, lines 5-15. An electroless copper plating solution is provided. Column 2, lines 20-25 and column 13, line 30 through column 14, line 10. The plating solution can comprise a first reducing agent (formalin) and a second hypophosphite reducing agent. Column 13, line 30 through column 14, line 10. The plating solution can also comprise a stablizer (2,2'-

bipyridyl), which would inhibit copper deposition. Column 13, lines 55-60 and column 6, lines 25-40 (as the material claimed by applicant for this purpose --see claim 5-- is used). The surface to be plated is plated with the plating solution. Column 9, lines 45-60. The addition of the second hypophosphite reducing agent provides desirable acceleration of the plating reaction when used with a TEA complexing agent. Column 13, line 65 through column 14, line 10 and Figure 9.

Kondo teaches all the features of this claim except the coating of the mirror surface with the claimed surface roughness and the plating thickness of 500 nm or less.

However, Uzoh teaches that it is well known when providing copper electroless plating that it is desirable to overplate substrates formed from silicon wafers, for example. Paragraphs [0005]--[0006]. The desirable copper plating can be 2-250 nm for a seed layer and 200 nm, for example, on a seed layer from a plating bath. Paragraphs [0006] and [0008].

Furthermore, Maenosono teaches that silicon wafers and other substrates with a roughness Ra (average surface roughness) of 10 nm or less, preferably 5 nm or less, are commonly coated by electrochemical deposition methods, for example. Paragraph [0030].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kondo to provide plating over a silicon wafer substrate with a mirror surface (roughness less than 10 nm) to provide a thin film of less than 500 nm thick as suggested by Uzoh and Maenosono in order to provide a desirable plating

on such silicon substrates as Kondo teaches a desirable copper electroless plating bath, with plating conditions that can provide nm thickness coatings based on amounts of reducing agent used and time of plating (see range of Figure 9) and Uzoh teaches that it is well known to desire to provide electroless copper plating of 200 nm thickness, for example, over silicon wafer surfaces, and Maenosono teaches that silicon wafer surfaces to be coated can desirably have average surface roughness of less than 5 nm, for example.

8. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo in view of Uzoh and Maenosono as applied to claim 1 above, and further in view of WO 01/49898 (hereinafter '898).

Kondo in view of Uzoh and Maenosono teaches all the features of this claim except the pretreatment agent. Kondo does show catalyzing the surface to be plated with palladium. Column 9, lines 45-55.

'898 teaches a desirable pretreatment agent to provide palladium on a surface with a mirror finish such as a semiconductor wafer is by using a pretreatment agent with a noble metal compound (including palladium as the noble metal) reacted or mixed in advance with a silane coupling agent having a functional group with metal capturing capability. Abstract and Example 5, pages 12-13. The pretreatment agent is applied to the substrate and then electroless plating is performed. Abstract. The plating can be using copper. Example 5, pages 12-13.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kondo in view of Uzoh and Maenosono to use a silane coupling agent pretreatment agent as suggested by '898 in order to provide a desirable adherence of the plating because Kondo teaches to provide a catalyst of palladium before plating, for example, and '898 teaches a desirable way to adhere a catalyst such as palladium using silane coupling agent as claimed before electrolessly plating.

9. WO 01/49898 was provided by applicant with the IDS statement of April 14, 2006.

10. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kondo in view of Uzoh and Maenosono as applied to claim 1 above, and further in view of Yoshida et al (US 2002/0011176) and Verbunt (US 2004/0152303).

Kondo in view of Uzoh and Maenosono teaches all the features of this claim except the specific first reducing agent and the use of hypophosphorous acid as the second reducing agent. Kondo does teach the stabilizing agent of 2,2'-bipyridyl. Column 13, lines 55-60 and column 6, lines 25-40.

However, Yoshida teaches that when providing copper electroless plating solutions, it is known to exchange formalin for glyoxylic acid as a reducing agent to provide a less problematic material, and that glyoxylic acid has a structure similar to formalin and is believed to having a oxidation reaction mechanism similar to formalin;

however, the plating reaction proceeds more slowly than with formalin. Paragraphs [0004]-[0007].

Furthermore, Verbunt teaches that when providing copper electroless plating solutions it is well known to provide hypophosphite in the form of sodium hypophosphite or to provide the hypophosphite from hypophosphorous acid. Paragraphs [0023] and [0026].

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Kondo in view of Uzoh and Maenosono to use glyoxylic acid as the first reducing agent as suggested by Yoshida in order to provide a desirable less problematic reducing agent because Kondo teaches to provide a reducing agent of formalin, and Yoshida teaches that it is well known to replace formalin with glyoxylic acid as a reducing agent with an expectation of similar reaction mechanism, but with less problems. One of ordinary skill in the art would expect the hypophosphite second reducing agent in Kondo to act in the same beneficial speeded reaction way with glyoxylic acid, because formalin has a similar reaction mechanism, and this speeded reaction is desired because glyoxylic acid solutions proceed more slowly. It would further have been obvious to modify Kondo in view of Uzoh, Maenosono and Yoshida to further replace the hypophosphite of Kondo with hypophosphorous acid as suggested by Verbunt with an expectation of desirable plating results, because Verbunt shows that hypophosphorous acid is a known desirable source for hypophosphite in copper electroless plating baths.



*Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Katherine A. Bareford whose telephone number is (571) 272-1413. The examiner can normally be reached on M-F(6:00-3:30) First Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy H. Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Katherine A. Bareford/  
Primary Examiner, Art Unit 1792